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EXAMINER	
KINGAN, TIMOTHY G	
ART UNIT	PAPER NUMBER
1772	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/762,563	PETERS ET AL.
	Examiner	Art Unit
	TIMOTHY G. KINGAN	1772

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 October 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *28-57* is/are pending in the application.

4a) Of the above claim(s) *28-50* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *51-57* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments with respect to claims 51 have been considered but are moot in view of the new ground(s) of rejection. However, pertinent to both the previous and the current office action, examiner maintains the position that "second input" 46" of McBride may function as an outlet. Structurally, it meets the claim, and McBride does not teach that fluid is introduced into this port in all embodiments. With regard to the capillarity in the region of the outlet, McBride does teach that capillary forces may participate in movement of fluid, as acknowledged by applicant, and one of ordinary skill in the art would have found obvious to use a capillarity at the outlet, even in the absence of the suggestion of McBride, at least equal to or greater than that at the inlet in order to ensure that fluid traverses the entire course of channel 48 to the last branch point, thereby preventing the introduction of features of a capillary stop that might otherwise comprise filling of the last branch channel. With regard to the pressurized system of fluid delivery taught by McBride, examiner notes that are not claimed or excluded by applicant. In fact, applicant does use pressure to overcome the capillary stop 9 in moving fluid into reaction chamber 10. Regarding the positioning of the reservoir adjacent to the first channel, examiner acknowledges the teaching of McBride comprising a reservoir separated from the microfluidic device 16 by a valve. However, McBride also teaches that fluids may be delivered via top layer 7, suggesting, to one of ordinary skill in the art, the desirability of providing a reservoir at the intersections of layer 7 and layer 8, the latter of which houses the microfluidic device. Finally, applicant

comments on Seki. Seki is pertinent to applicant's claims in the teaching of capillarity, as acknowledged by applicant, but also for the teaching that first and second channels in a fluid metering device may be arranged horizontally. Applicant, McBride and Seki are all concerned with devices configured to generate fluid plugs of defined volume from a source of larger volume, and it would be apparent to one of ordinary skill in the art, from the prior art references, that such goal may be accomplished in a number of ways.

2. Applicant's arguments filed 10/20/2010 (p. 15) with respect to the rejection of Claim 54 under 35 U.S.C. 112, first paragraph have been fully considered and are persuasive. The rejection is withdrawn.

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. **Claims 51-53** are rejected under 35 U.S.C. 103(a) as being unpatentable over S.E. McBride, U.S. Patent 6,395,232 (herein after McBride) in view of C.C. Karp, U.S. Patent Application Publication 2003/0005967 (herein after Karp) and M. Seki et al., U.S. Patent Application Publication 2002/0195463 (herein after Seki).

For Claims 51-53, McBride teaches a microfluidic fluid delivery and distribution system having a fluid input (abstract), **46** coupled to a reservoir **14** and a main channel **48** which in turn has various branches **50** (col 5, lines 36-47; Figs. 5-7) (first channel with one inlet, divided into sections defined by branch channels, equivalent to applicant's second channels, each second channel branching off from the first channel

at a branch point, the branch points located sequentially along the first channel; each second channel having a predetermined volume forming a discrete flow path). Further, the branch channels **50** each have an outlet comprising a capillary break **56** (col 5, lines 49-51 Figs. 5-7) (a stopping means at the outlet of the second channels and the inlet of each of the third channels; see below for McBride's third channels).

McBride does not teach the first channel has one outlet. However, McBride does teach that the main channel may be provided with a second input **46"** to overcome the pressure drop from the input to the branch points (col 6, lines 28-32). Examiner notes that such second input may also function as an outlet of the first channel. Moreover, use of such single outlets of main channels in fluid distribution systems comprising sequential branched channels is known in the art. Karp teaches systems for metering microfluidic volumes (abstract) comprising a single outlet port **311** serving a trunk channel **313** filling branch channels **314** ([0055]; Fig. 1A). It would have been obvious to one of ordinary skill in the art to use an outlet in order to provide an adequate vent for gas being pushed through the main channel as it is filled with fluid from the reservoir.

McBride does not specifically teach each successive second channel fills before the following second channel <u>owing to its greater capillary force</u> with respect to the first channel. However, McBride does disclose that fluids may be moved through the fluidic system by draining or capillary action, as well as pumping (col 4, lines 25-28) (second channels have a greater capillary force than the third channels). Further, McBride teaches the second channels fill sequentially from the closest to the most distant with respect to the fluid input (col 5, lines 62-65) (a second channel begins filling when the

second channel connected to a preceding branch point is completely filled). Applicant's greater capillarity at the branch points appears to be an inherent property of McBride's channel system, since fluid is directed to second channels instead of continuing in the first channel, a straight line fluid path.

While McBride and Karp do not specifically teach the capillarity in the area of the outlet of the first channel with respect to its inlet, as noted above, McBride does teach that force in fluid flow may be provided by capillary action. It would have been obvious to one of ordinary skill in the art to use capillarity at the outlet at least as great as that at the inlet in order to promote complete filling of the main channel under conditions of low pressure provided at the inlet.

With regard to at least one of the second channels forming a second channel system, McBride teaches that the branches **50** comprise first section **54** and second section arranged at a right angle to **54** (forming a recess or cavity in the second channel), and a third short section (second and third sections not labeled) leading to the capillary break **56** (at least one of the second channels divided into sections ending at a means for stopping a liquid flow) (Figs. 5-7). McBride does not teach the capillarity of said sections in comparison to that at the branch point. However, in view of McBride's teaching that the low pressure subsystem supplying the branch channels is insufficient to break the capillary break **56** (col 5, lines 60-61), it would have bee obvious to one of ordinary skill in the art to provide for at least the same or increasing capillarity in order to ensure continuous flow up to the break. The only alternative, an increased capillarity, would be counterintuitive to one of ordinary skill in the art, since it might prevent filling of

the second channels. Finally, it appears that a change in capillarity is not required in the device of McBride, which relies on a low pressure subsystem for transport to reaction wells **52** (col 5, lines 52-56). Such consideration would suggest to one of ordinary skill in the art that the compared capillarities may be equal.

With regard to third channels, McBride teaches that following each branch channel **54** is a capillary break **56**, beyond which flow continues to a reaction well **52** (col 5, lines 40-42) (third channel) and then to an outlet (Figs. 5-7) (a plurality of third channels provided with an inlet and outlet, each third channel downstream from one of said second channels).

Further for Claim 52 with regard to third channels, McBride teaches fluid from the capillary breaks **56** enters the reaction wells **52** (col 5, lines 62-67; Figs. 6 and 7) (each third channel connected to a separate stopping means) and that the reaction wells each have an outlet (Figs. 5-7) (each third channel has a second outlet wherein the liquid exiting each outlet does not mix with that of other outlets).

Further for Claims 51 and 52 McBride does not teach first, second and third channels provided on the same planar surface. However, Karp teaches that trunk channel **313** and branch channels 314 are provided on a single planar surface in a device configured to meter microfluidic quantities of fluid from a larger volume [0054]. Further Seki teaches that fluid may be metered from a larger flow channel A into smaller branch channels C by means of a stronger capillary force at the opening c1 [0013] and that such channels may be provided on a single base plate **12** (planar surface) ([0050]-[[0054]; Figs. 2(a)- 2(b)). Therefore, it would have been obvious to one of ordinary skill

in the art to orient first, second and third channels on a single plane, according to the teaching of Seki and in the device of McBride and Karp, and with reasonable expectation of success, in order to provide the convenience of photolithographic approaches utilizing masks in fabricating complex fluidic elements comprising intersecting channels, according to the teaching of Seki [0069]. Further, one of ordinary skill in the art would have found desirable use of a planar surface in order to accommodate the additional complexity of capillary stops and widened reaction chambers in the device of McBride and Karp.

Further for Claim 53, McBride does not teach the claimed widened recess with narrower first and second portions of the second channel on either side of the recess. However, such recesses and their value in delivering metered amounts of fluid are known in the art. Karp teaches metering of fluids in microfluidic devices comprising plug chambers **475**, **476**, **485**, **486**, **490** and **491**, wider than channels on either side (recess of width greater than connecting channels), for delivering known amounts of fluid to downstream mixing chambers ([0066], Fig. 6A). It would have been obvious to one of ordinary skill in the art to provide a known means of controlling the volume of fluid to be delivered by metering means downstream to mixing or reaction chambers, according to the teaching of Karp.

3. **Claims 55-57** are rejected under 35 U.S.C. 103(a) as being unpatentable over McBride, Karp and Seki as applied to claims 51, 52 and 53 above, and further in view of B.L Karger et al., U.S. Patent 5,872,010 (herein after Karger).

For Claims 55-57, McBride, Karp and Seki do not teach a reservoir on the same planar surface as the first second and third channels. However, such arrangement of reservoirs with microfluidic channels on a single substrate is known in the art. Karger teaches systems for handling fluids in microfluidic devices (abstract), one embodiment of which comprises a substrate 11 containing channels or grooves 12 along with associated inlet ports and reservoirs 13, 14 and 15 in one surface of a planar portion of a chip 10 (col 6, lines 1-20; Fig. 1A). It would have been obvious to one of ordinary skill in the art to provide, as an alternative to external reservoir **14** in the teaching of McBride, to provide fluid via reservoirs associated with the distribution plate **8** of McBride, accessible from top plate **7**, such alternative suggested by McBride (col 4, lines 26-30), in order to simplify fabrication and assembly of the system and to make use of drainage, according to McBride, as a simplified means of delivering fluid to the channel system.

4. **Claim 54** is rejected under 35 U.S.C. 103(a) as being unpatentable over McBride in view of Karp, R.E. Pelrine and R.D. Kornbluh, U.S. Patent Application Publication 2003/0141473 (herein after Pelrine) and Seki.

For Claim 54, McBride teaches a microfluidic fluid delivery and distribution system having a fluid input (abstract), **46** coupled to a reservoir **14** and a main channel **48** which in turn has various branches **50** (col 5, lines 36-47; Figs. 5-7) (first channel with one inlet, divided into sections defined by branch channels, equivalent to applicant's second channels, each second channel branching off from the first channel

at a branch point, the branch points located sequentially along the first channel; each second channel having a predetermined volume forming a discrete flow path). Further, the branch channels **50** each have an outlet comprising a capillary break **56** (col 5, lines 49-51 Figs. 5-7) (a stopping means at the outlet of the second channels and the inlet of each of the third channels; see below for McBride's third channels).

McBride does not teach the first channel has one outlet. However, McBride does teach that the main channel may be provided with a second input **46"** to overcome the pressure drop from the input to the branch points (col 6, lines 28-32). Examiner notes that such second input may also function as an outlet of the first channel. Moreover, use of such single outlets of main channels in fluid distribution systems comprising sequential branched channels is known in the art. Karp teaches systems for metering microfluidic volumes (abstract) comprising a single outlet port **311** serving a trunk channel **313** filling branch channels **314** ([0055]; Fig. 1A). It would have been obvious to one of ordinary skill in the art to use an outlet in order to provide an adequate vent for gas being pushed through the main channel as it is filled with fluid from the reservoir.

McBride does not specifically teach each successive second channel fills before the following second channel <u>owing to its greater capillary force</u> with respect to the first channel. However, McBride does disclose that fluids may be moved through the fluidic system by draining or capillary action, as well as pumping (col 4, lines 25-28) (second channels have a greater capillary force than the third channels). Further, McBride teaches the second channels fill sequentially from the closest to the most distant with respect to the fluid input (col 5, lines 62-65) (a second channel begins filling when the

second channel connected to a preceding branch point is completely filled). Applicant's greater capillarity at the branch points appears to be an inherent property of McBride's channel system, since fluid is directed to second channels instead of continuing in the first channel, a straight line fluid path.

While McBride and Karp do not specifically teach the capillarity in the area of the outlet of the first channel with respect to its inlet, as noted above, McBride does teach that force in fluid flow may be provided by capillary action. It would have been obvious to one of ordinary skill in the art to use capillarity at the outlet at least as great as that at the inlet in order to promote complete filling of the main channel under conditions of low pressure provided at the inlet.

With regard to at least one of the second channels forming a second channel system, McBride teaches that the branches **50** comprise first section **54** and second section at right angle, forming a recess or cavity in the second channel, and a third short section (both not labeled) leading to the capillary break **56** (at least one of the second channels divided into sections ending at a means for stopping a liquid flow; each third section connected to a capillary stop which discharges into reaction chamber **52** and then to one of a plurality of second outlets) (Figs. 5-7). McBride does not teach the capillarity of said sections in comparison to that at the branch point. However, in view of McBride's teaching that the low pressure subsystem supplying the branch channels is insufficient to break the capillary break **56** (col 5, lines 60-61), it would have bee obvious to one of ordinary skill in the art to provide for at least the same or increasing capillarity in order to ensure continuous flow up to the break. The only alternative, an increased

capillarity, would be counterintuitive to one of ordinary skill in the art, since it might prevent filling of the second channels. Finally, it appears that a change in capillarity is not required in the device of McBride, which relies on a low pressure subsystem for transport to reaction wells **52** (col 5, lines 52-56). Such consideration would suggest to one of ordinary skill in the art that the compared capillarities may be equal.

With regard to third channels, McBride teaches that beyond each branch channel **54** is a capillary break **56**, beyond which flow continues to a reaction well **52** (col 5, lines 40-42) (third channel) and then to an outlet (Figs. 5-7) (a plurality of third channels provided with an inlet and outlet, each third channel downstream from one of said second channels).

Further with regard to third channels, McBride teaches fluid from the capillary breaks **56** enters the reaction wells **52** (col 5, lines 62-67; Figs. 6 and 7) (each third channel connected to a separate stopping means) and that the reaction wells each have an outlet (Figs. 5-7) (each third channel has a second outlet wherein the liquid exiting each outlet does not mix with that of other outlets).

With regard to the cover, McBride teaches that the microfluidic device **16** comprises a top layer **7** which serves as a cover for the device, apertures **13** in layer **8** of which lead to the micro-channel **48** with its branch channels (second channels) (col 3, lines 38-45; Figs. 2 and 5-7) (the microfluidic arrangement has a cover).

Further with regard to third channels, McBride teaches fluid from the capillary breaks **56** enters the reaction wells **52** (col 5, lines 62-67; Figs. 6 and 7) (each third channel connected to a separate stopping means) and that the reaction wells each have

an outlet (Figs. 5-7) (each third channel has a second outlet wherein the liquid exiting each outlet does not mix with that of other outlets).

McBride is silent on limitations that channels are arranged as grooves or troughs in a surface covered by a cover. While the channel system of McBride is arranged in the distribution plate **8** with inlets from the top or sample plate, which also serves as a cover, and outlet to the bottom or well plate, McBride is not specific on the alternative configurations including of 1) orienting channels of the system as grooves or troughs in a surface or as a tube passing through, rather than in, a surface. However, the configuration of arranging channels as grooves in a surface is known in the art. Pelrine teaches fluid-transporting features associated with microfluidic application comprise channels formed as an open groove or trench in a surface [0034] formed by any method known in the art [0048], and that channels may support a fluid distribution system comprising channels that branch successively from a main channel [0006]. It would have been obvious to one of ordinary skill in the art to use, and with reasonable expectation of success, such configuration of grooves in a surface, according to the teaching of Pelrine, as one of a limited number of alternative and equivalent configurations in serving fluid distribution, in order to provide a conventional orientation of possible reaction chambers close to a surface that may be easily visually monitored through a transparent cover.

Further for Claim 54, McBride does not teach first, second and third channels provided on the same planar surface. However, Karp teaches that trunk channel **313** and branch channels **314** are provided on a single planar surface in a device configured

to meter microfluidic quantities of fluid from a larger volume [0054]. Further Seki teaches that fluid may be metered from a larger flow channel **A** into smaller branch channels **C** by means of a stronger capillary force at the opening **c1** [0013] and that such channels may be provided on a single base plate **12** (planar surface) ([0050]-[[0054]; Figs. 2(a)- 2(b)). Therefore, it would have been obvious to one of ordinary skill in the art to orient first, second and third channels on a single plane, according to the teaching of Seki and in the device of McBride and Karp, and with reasonable expectation of success, in order to provide the convenience of photolithographic approaches utilizing masks in fabricating complex fluidic elements comprising intersecting channels, according to the teaching of Seki [0069]. Further, one of ordinary skill in the art would have found desirable use of a planar surface in order to readily accommodate in fabrication the additional geometric complexity associated with capillary stops and widened reaction chambers in the device of McBride and Karp.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TIMOTHY G. KINGAN whose telephone number is (571)270-3720. The examiner can normally be reached on Monday-Friday, 8:30 A.M. to 5:00 P.M., E.S.T..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, In Suk Bullock can be reached on 571 272-5954. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TGK

/In Suk Bullock/
Supervisory Patent Examiner, Art Unit 1772